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Abalone Resurvey in the Estevan Group and Aristazabel Island, June 1989

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ABSTRACT

Farlinger, S., G.A. Thomas, I. Winther and W. Carolsfeld. 1991. Abalone Resurvey in the Estevan Group and Aristazabal Island, June 1989. Can. MS Rep. Fish. Aquat. Sci. 2104: 39 p.

Abalone (Haliotis kamtschatkana) populations were resurveyed in 25 sites in area 6 of the Central Coast. The 16 quadrat method of previous surveys was used. Results were compared to those obtained in 1979/80, 1983 and 1985. Number of abalone, legal abalone, recruit abalone and pre-recruit abalone per square meter were less than in previous surveys. There had been no apparent decline between 1983 and 1985, although 1983 results were 50% less than earlier surveys. The survey may not be adequate to measure the change in abundance; the design and methodology should be reviewed. The apparent decline may be local; port sampling and the 1990 survey in the Queen Charlotte Islands will provide more information.

RESUME

Farlinger, S., G.A. Thomas, I. Winther and W. Carolsfeld. 1991. Abalone Resurvey in the Estevan Group and Aristazabal Island, June 1989. Can. MS Rep. Fish. Aquat. Sci. 2104: 39 p.

Une nouvelle campagne d'échantillonnage des populations de l'haliotide Haliotis kamtschatkana a été effectuée dans 25 sites du secteur 6 de la zone centrale. La méthode des 16 quadrats des campagnes précédentes a été de nouveau utilisée. Les résultats ont été comparés à ceux de 1979-1980, 1983 et 1985. Les nombres d'haliotides adultes et de taille légale de meme que des recrues et pré-recrues par mètre carré étaient moins éléves que lors des campagnes précédentes. Il n'y a pas eu de déclin manifeste des populations de 1983 à 1985, mais l'abondance des populations en 1983 était deux fois inférieure à celles observées lors des campagnes des années antérieures. Il se pourrait que ces campagnes ne permettent pas de mesurer les variations d'abondance; il faudrait en réviser la conception et la méthodologie. Lé declin manifeste observé porrait être local; un échantillonnage effectué dans les eaux portuaires et la campagne de 1990 dans les iles de la Reine-Charlotte fourniront des informations supplémentaires.

INTRODUCTION

Northern abalone (Haliotis kamtschatkana) stocks in British Columbia have been assessed with surveys carried out in areas of major commercial abalone production. Two areas have been used as indicators to assess relative abalone (Haliotis kamtschakana) abundance. These areas are the East Coast of the Queen Charlotte Islands (Carolsfeld et al, 1987; Boutillier et al 1985; Breen and Adkins, 1979) and area 6 of the Central Coast of British Columbia (Farlinger and Bates, 1985; Boutillier et al, 1984; Breen and Adkins, 1982; 1981; 1980). This report summarizes the 1989 survey of the Central Coast.

The Estevan Group and Aristazabal Island, Area 6 (Fig. 1) have provided a substantial but declining portion of the landings for the commercial fishery for northern abalone since the mid 1970's (Table 1). As part of an ongoing program 25 standard sites in this area were surveyed for an index of abalone (Haliotis kamtschatkana) abundance in June 1989.

Management of the abalone fishery in British Columbia has been discussed briefly in stock assessment documents (above) and more completely in reviews by Sloan and Breen (1989), Breen (1986) and Fedorenko and Sprout (1982). The abalone quota in 1989 remained at 47.2 metric tonnes divided equally among 26 licences. The minimum size limit was 100 mm.

Past surveys have indicated an overall decline in abundance of about 50% between 1979 and 1983 as measured by the number of legal abalone per square meter (Breen and Adkins, 1981; 1982; Boutillier et al, 1984). No further decline was noted between 1983 and 1985 (Farlinger and Bates, 1986). Information obtained in the survey described here suggests a further decline.

METHODS

The Fisheries Patrol Vessel Kitimat II acted as the base for dive operations. Two 4.5 m inflatable boats were employed as diving platforms. Divers Wolfgang Carolsfeld from Science Branch and Greg Thomas and Ivan Winther of Fisheries Branch conducted the survey. Carolsfeld dove during the surveys of these sites in 1983 and 1985 and Thomas dove during the 1985 survey.

Sites were selected specifically from those surveyed in 1983 and 1985 to facilitate comparison. These sites had been chosen from non-zero sites in the original surveys (Breen and Adkins, 1980; 1981; 1982, Boutillier et al, 1985). Sites were identified from the surface with the aid of field notes, charts, and the experience of the divers involved in previous surveys. 1989 sites were probably located within 100 m of those sampled previously.

Breen and Adkins (1979) describe the sampling technique. Divers entered the water and swam up slope to the upper extent of the abalone habitat (ie. the minimum depth abalone were sighted during

the initial swim). The first quadrat was placed at the same depth 5 m from this location. Quadrats were positioned at distances of 1, 3, 5 and 7 m along 4 parallel transects each 4 m apart running seaward. The total of 16 quadrats covered an area 7 by 16 m. At each of the 16 positions in the grid a 1 m square metal quadrat was placed on the bottom and any kelp plants obscuring vision within the quadrat were cut and removed. Abalone were counted and collected from within the quadrat; separate collections and enumerations were kept for exposed and cryptic abalone. Exposed abalone were those found without moving rocks or examining crevices, while cryptic abalone were found by checking crevices and turning over and examining all moveable rocks. Abalone lying on the edge of the quadrat were only considered inside if the spire of the shell was within the quadrat. Sampling was terminated if no abalone were found in the first 8 quadrats.

At each site , the topography, substrate type, site exposure and dominant algae were identified and the percentage cover estimated and recorded. All abalone collected were counted and measured at the surface. Maximum and minimum depths of each site were recorded.

Results and data were grouped by geographical area and by abalone size. Four abalone size groups were considered: Total abalone refer to all abalone of any size collected in a sample; legal abalone refer to only those abalone greater than 100 mm in shell length; prerecruit abalone are between 94 and 101 mm in shell length and new recruit abalone are between 102 and 107 mm in shell length. Prerecruits represent abalone that would have entered the fishery in the next 12 months and new recruits represent abalone that had entered the fishery in the past 12 months (Farlinger and Bates, 1985).

Results were compared to past surveys.

RESULTS

25 of 26 sites surveyed in 1989 were common to those surveyed in 1983 and 1985; 11 of the sites were common to 1979/80 survey sites (Table 2).

There was a discrepancy between the number of abalone counted underwater and those collected and measured at site 15. Only 36 abalone were counted but 38 abalone were collected. Communication difficulty between the divers is suspected so the value of 38 was used in the density measurements. This site should be excluded from any analysis of variance.

Table 2 provides the mean total and mean legal abalone densities per square meter for each site and for the survey area. Because of the extremely low numbers of animals involved no formal analysis has been undertaken. Although significance at the levels found among years is difficult to show, actual number of legal abalone per square meter has decreased to .11 from .23 and .36 in 1983 and 1985 when the same 25 sites are compared. Similarly the mean total abalone density has decreased to .58 from 1.43 and 1.57 in 1983 and 1985. The trend is substantiated by the increased number of sites with no legal

abalone and the presence of two sites without any abalone in the 1989 samples (Table 2).

Table 3 compares abalone densities at the 25 sites common to 1989, 1985 and 1983 surveys. 1989 abalone densities have decreased in the order of 50% from 1983 and 1985 values for all abalone size classes; total, legal, pre-recruit and recruit. Table 4 compares the 11 sites common to 1979/80, 1983, 1985 and 1989. Decreases in the order of 80% are found in recruit, prerecruit, and legal sized abalone when comparing 1979/80 densities to 1989.

Table 5 summarizes all abalone samples from the four survey periods 1979/80, 1983, 1985, and 1989.

Site 18, not compared in the tables 2 and 3, had a total abalone density of 1.1 abalone/m^2. All of these abalone were less than 90 mm in length (Appendix 1).

Abalone shell length averaged 80 mm in the 1989 survey (Table 6), similar to the values of 81 and 83 mm obtained in 1983 and 1985. Abalone shell length frequencies are presented in Figures 2 and 3. The majority of abalone sampled were between 50 and 100 mm. Abalone less than 40 mm were present in the areas of Weeteeam Bay, Aristazabal North and Estevan South but were noticeably absent from the Pemberton Bay area.

Only 5 of the 232 abalone collected and measured from the quadrats sampled were cryptic.

Commercial abalone landings in Prince Rupert have been sampled by Fishery officers and Biological staff. Abalone are measured as they are unloaded at the dock. Table 7 provides a summary of samples from 1985 to 1989. Mean abalone size in the commercial fishery has remained between 110 and 115 mm.

DISCUSSION

Abalone densities were compared between years (1989 versus 1985 and 1983) using Wilcoxon signed rank tests. The decline in abalone density is significant ($p < 0.05$); although in terms of management responsibility, the fact that abalone densities are at such a low level as to be difficult to measure raises concerns. Several publications (Breen, 1986; Sloan and Breen, 1988) have pointed out that the 16 quadrat method is not inherently strong for use in measuring changes in abundance over time at such low densities.

Abalone landings from Area 6 have declined from near 40% of the annual quota at the turn of the decade to less than 16% recently (Table 1). Abalone declines may not be all fishery induced. Commercial fishing would not account for the decrease in the number of sub-legal sized abalone between 1985 and 1989. Movement of abalone into more desirable sites, or pressure from predators or disease cannot be ruled out. Sea otters have been sited in the Goose Group, 60 km southeast of the survey area (G. Ellis pers. comm.).

Mottet (1978) considers sea otters the greatest source of danger to abalone populations in North America and suggests that a commercial fishery cannot exist in an area occupied by sea otters. Although sea otters have not yet been observed in area 6, further expansion of their range is probable and may play an important role in future fisheries. Bower (1987) described a protozoan parasite of juvenile abalone in a mariculture situation in British Columbia but diseases and parasites in wild populations are not well documented (Sloan and Breen, 1988).

Monitoring of the size of abalone in the commercial catch from area 6 will continue in an attempt to substantiate the results. A further survey in the Queen Charlotte Islands is proposed for 1990; similar results in that area would be cause for concern and management review.

Anecdotal information from fishermen indicates the area surveyed in 1989 had been recently harvested and was left fallow while other locations were fished. A review of the survey design should consider the inclusion of additional sites in future to provide a more representative index of abundance. Bearing in mind the potential limitations of the survey design, this survey suggests an overall decrease in abundance of abalone in the area surveyed.

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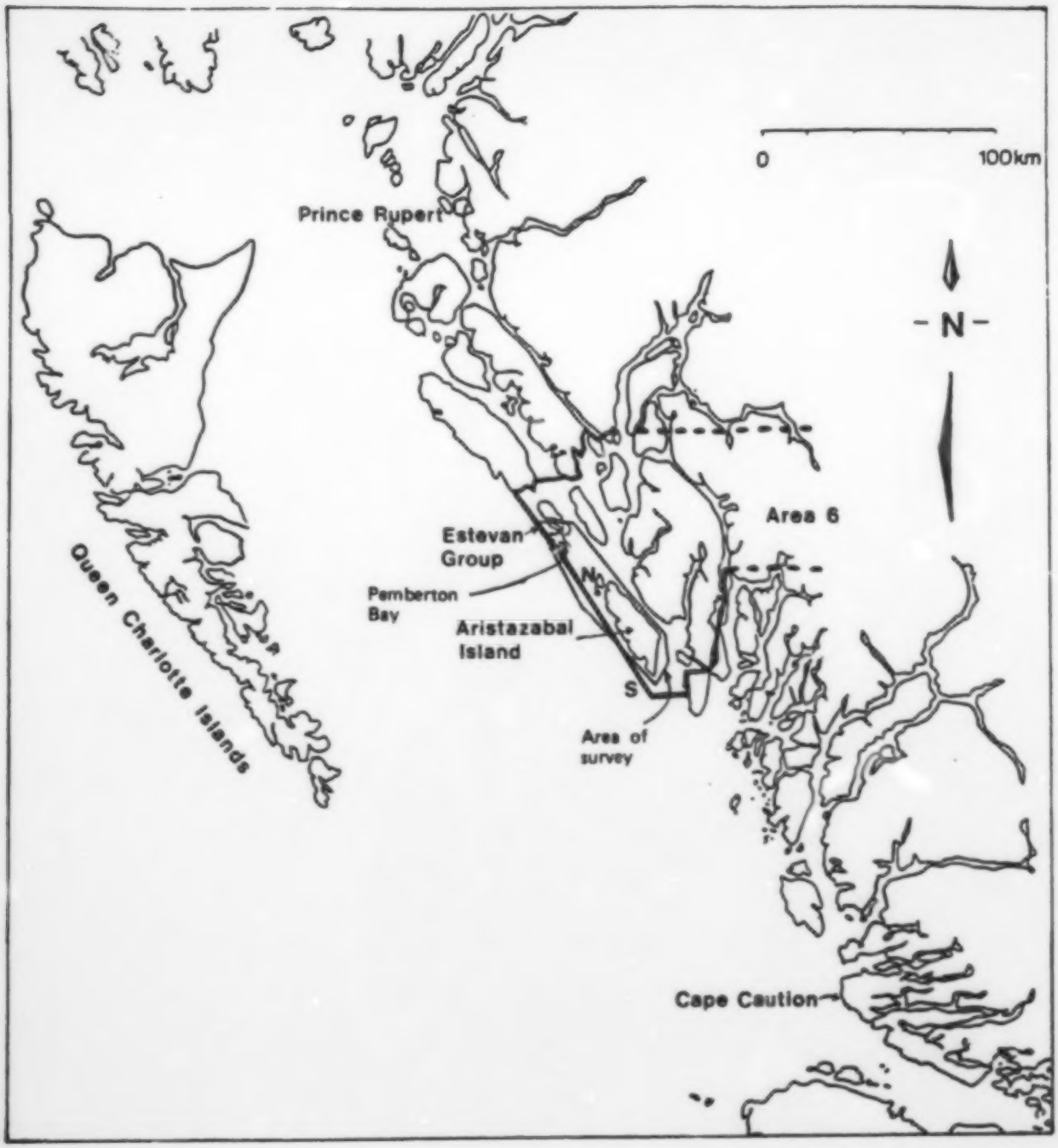

Fig. 1. North Coast of British Columbia showing the area of survey.

Table 1. Abalone landed (kg) and percent of quota taken from Area 6, British Columbia, 1979-1988.

YEAR	QUOTA (kg)	WEIGHT (kg)	PERCENT OF QUOTA
1979	226,400	87,000	38%
1980	113,400	44,519	39%
1981	94,347	37,756	40%
1982	94,347	27,058	29%
1983	70,760	7,538	11%
1984	58,967	9,899	17%
1985	47,174	10,820	23%
1986	47,174	4,170	9%
1987	47,174	7,669	16%
1988	47,174	5,303	11%
1989	47,174	7,450	16%

Landings from logbook information.

TABLE 2. TOTAL AND LEGAL ABALONE (100 + mm) DENSITIES (#/M2) AT SITES RESURVEYED, 1979-80, 1983, 1985 AND 1989.

SITE		DENSITY (#/M2)							
1979-1980	1983 1985 1989	1979-80 LEGAL	1979-80 TOTAL	1983 LEGAL	1983 TOTAL	1985 LEGAL	1985 TOTAL	1989 LEGAL	1989 TOTAL
ESTEVAN SOUTH									
79-18	21	0.84	1.38	0.44	1.44	0.94	1.31	0.13	0.25
79-20	22	0.23	0.81	0.31	0.62	0.19	0.62	0.31	0.38
79-08	23	0.78	4.4	0.25	2.56	0.12	2.50	0.25	1.44
79-09	24	0.27	1.63	0.00	0.69	0.31	0.88	0.06	0.19
80-70	25	0.44	na	0.38	1.75	0.31	1.12	0.25	0.69
80-06	27	0.13	1.31	0.13	0.38	0.25	0.62	0.19	0.19
-	29	-	-	0.31	2.06	0.65	2.00	0.00	0.13
-	30	-	-	0.88	4.69	1.44	2.88	0.19	0.63
ESTEVAN MEAN		na	na	0.34	1.77	0.53	1.49	0.17	0.48
PEMBERTON BAY									
-	33	-	-	0.19	1.75	0.07	0.87	0.00	0.48
-	34	-	-	0.31	2.38	0.18	1.00	0.00	0.00
-	35	-	-	0.19	3.31	0.06	1.56	0.00	0.06
80-07	36	1.16	na	0.12	1.63	1.00	3.38	0.13	1.44
PEMBERTON MEAN		na	na	0.20	2.27	0.33	1.70	0.04	0.57
ARISTAZABAL NORTH									
79-27	13	0.48	na	0.06	0.56	0.25	2.19	0.00	0.19
79-12	15	0.27	1.94	0.25	1.06	0.12	1.19	0.13	2.38
-	16	-	-	0.06	0.38	0.12	1.31	0.06	0.25
79-14	17	0.21	1.06	0.00	1.75	0.00	2.31	0.06	0.94
79-11	19	0.55	na	0.44	1.06	0.56	1.56	0.19	0.44
-	20	-	-	0.31	0.38	0.38	0.81	0.19	0.38
ARISTAZABAL MEAN		na	na	0.19	0.86	0.24	1.56	0.10	0.76
ARISTAZABAL SOUTH		[WEETEEAM BAY]							
-	4	-	-	0.25	0.50	0.06	0.25	0.06	1.13
-	6	-	-	0.00	1.06	0.00	0.25	0.00	0.06
-	8	-	-	0.38	2.31	0.25	2.81	0.19	0.56
-	9	-	-	0.00	0.88	0.44	1.06	0.00	0.19
-	10	-	-	0.19	1.00	1.06	4.12	0.13	0.44
-	11	-	-	0.06	0.81	0.00	1.88	0.13	0.38
-	12	-	-	0.25	0.69	0.19	1.06	0.00	0.00
ARISTAZABAL SOUTH		na	na	0.16	1.04	0.29	1.63	0.08	0.45
ALL SITES MEAN		na	na	0.23	1.43	0.36	1.57	0.11	0.58
11 common mean		0.49	na	0.22	1.23	0.37	1.61	0.15	0.77
NO. OF '0' SITES		na	na	3	0	3	0	8	2

na = not available

TABLE 3. ABALONE DENSITIES (#/M2) FROM 25 COMPARABLE SITES RESURVEYED IN 1983, 1985 AND 1989.

	MEAN DENSITY (#/M2)		
	1983	1985	1989
TOTAL ABALONE MEAN	1.43	1.57	0.56
LEGAL ABALONE MEAN (100+ mm)	0.22	0.34	0.11
PRE-RECRUIT ABALONE MEAN (94-100 mm)	0.18	0.25	0.08
RECRUIT ABALONE MEAN (102-107 mm)	0.10	0.14	0.03

TABLE 4. ABALONE DENSITIES (#/M2) FROM 11 COMPARABLE SITES RESURVEYED IN 1979/80, 1983, 1985 AND 1989.

	MEAN DENSITY (#/M2)			
	1979/80	1983	1985	1989
TOTAL ABALONE MEAN	NA	1.43	1.57	0.56
LEGAL ABALONE MEAN (100+ mm)	0.49	0.22	0.34	0.11
PRE-RECRUIT ABALONE MEAN (94-100 mm)	0.46	0.18	0.25	0.08
RECRUIT ABALONE MEAN (102-107 mm)	0.25	0.10	0.14	0.03

NA = not available

Table 5: Summary of abalone sampling in Area 6 since 1979.

Survey	Quadrats	Total Abalone	Legal Abalone	Total Density	Legal Density	% Legal
1989	400	232	42	0.58	0.11	18.1
1985	448	683	148	1.52	0.33	21.7
1983	512	977	161	1.91	0.31	16.5
1979/80	817	2236	530	2.74	0.65	23.7

TABLE 6. MEAN ABALONE LENGTHS (mm) FROM 1983, 1984, AND 1989 SURVEYS IN THE CENTRAL COAST, B.C.

	LENGTH (mm)			CHANGE		
	1983	1985	1989	1983-1985	1983-1989	1985-1989
ESTEVAN (ESTEVAN SOUTH)	83.80	90.37	89.82	6.57	6.02	-0.55
PEMBERTON BAY	77.71	81.79	80.38	4.08	2.67	-1.41
ARISTAZABAL N.	81.09	76.89	77.68	-4.20	-3.41	0.79
ARISTAZABAL S. (WEETEEAM BAY)	79.88	82.43	71.30	2.55	-8.58	-11.13
TOTAL	81.06	83.42	80.00	2.36	-1.06	-3.42

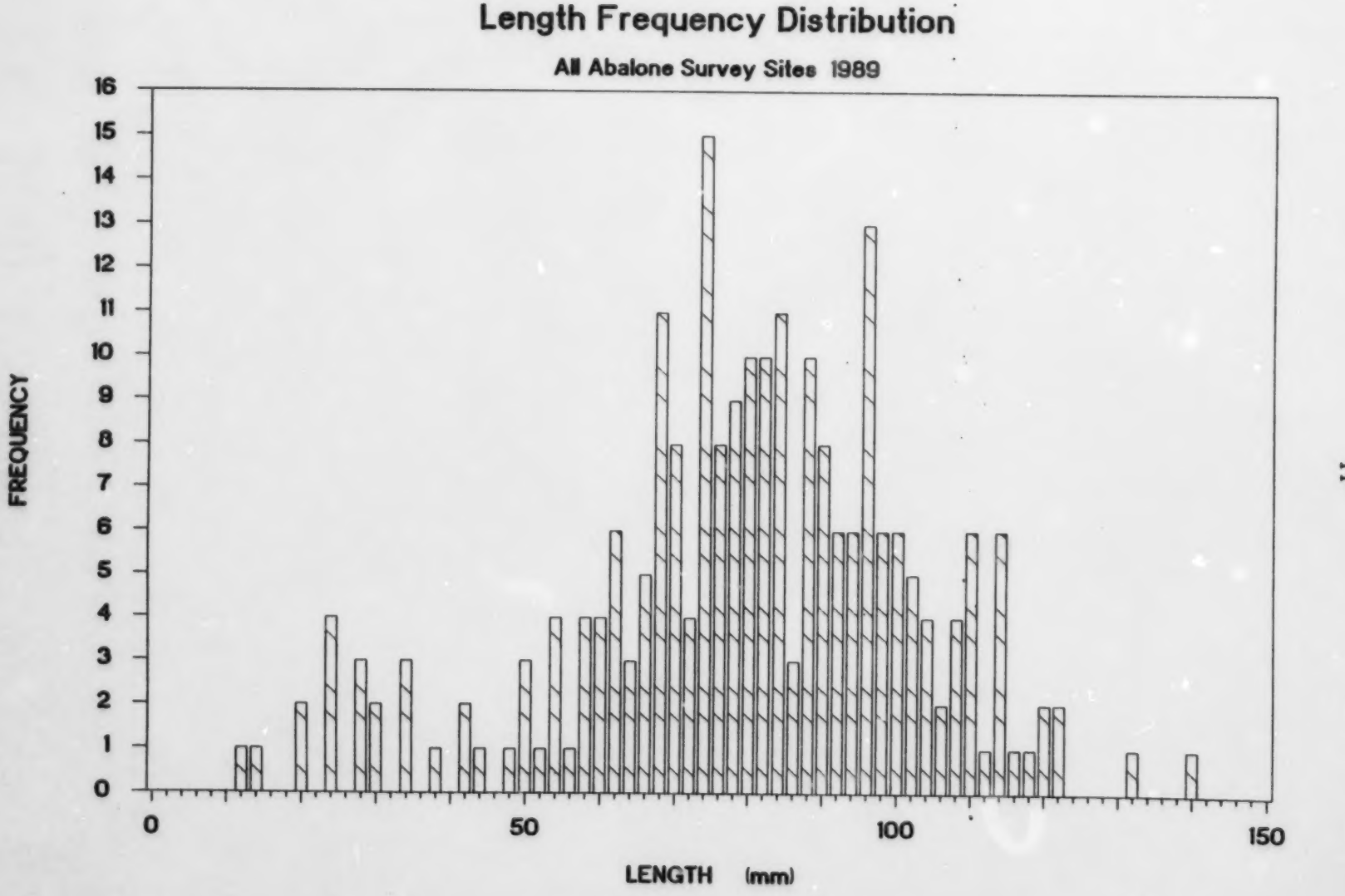

Figure 2: Length frequency distribution of all abalone sampled in 1989.

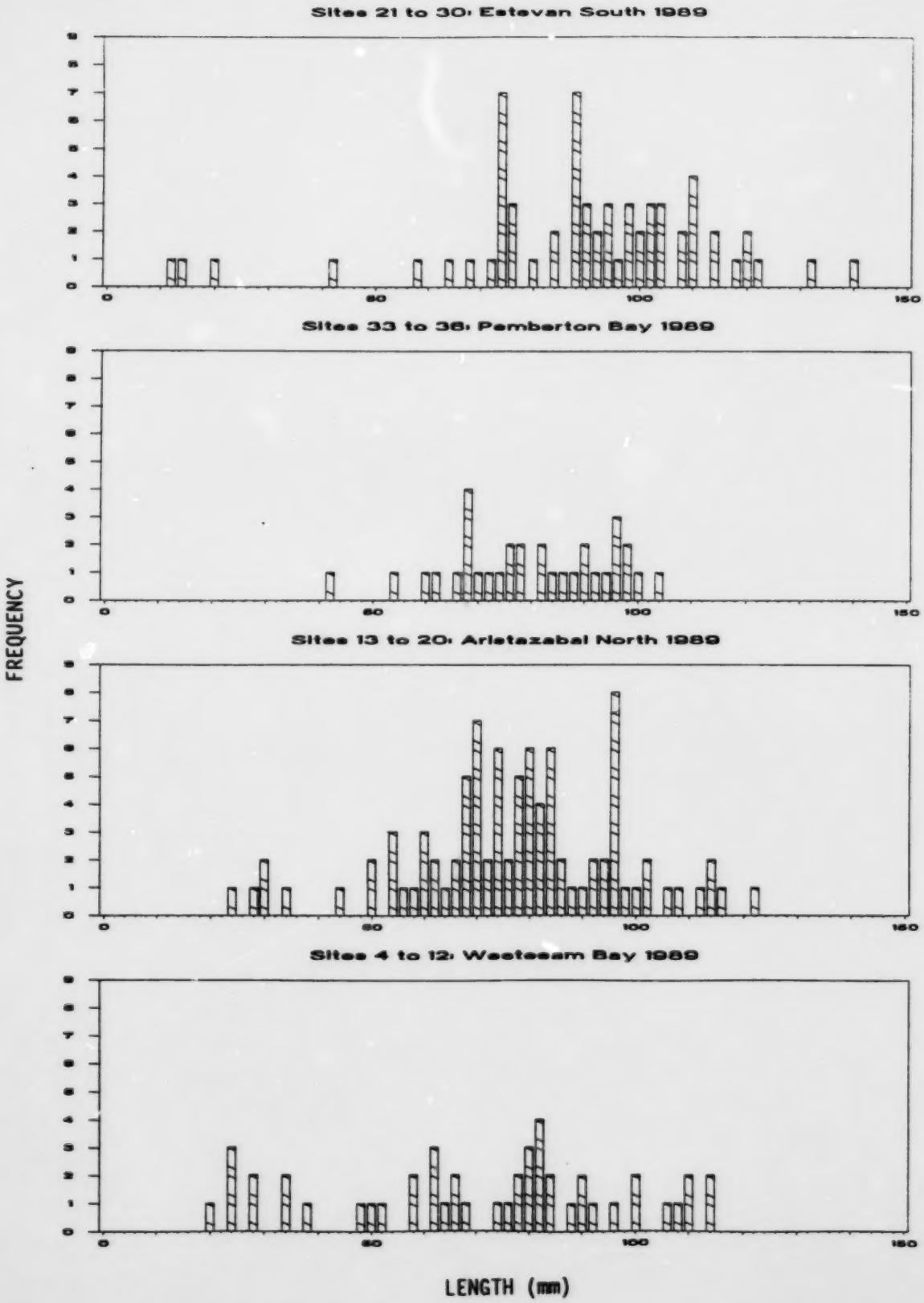
Sites 21 to 30: Estevan South 1989
Sites 33 to 38: Pemberton Bay 1989
Sites 13 to 20: Arlatazabal North 1989
Sites 4 to 12: Westeeam Bay 1989
FREQUENCY
LENGTH (mm)

Figure 3: Length frequency distribution of abalone sampled in four subareas surveyed in 1989.

Table 7: Summary of abalone port samples 1985 to 1989, Prince Rupert, B.C.

Date	Area	Number sampled	Mean length (mm)	Std. Dev. (mm)	Min. size (mm)	Max. size (mm)	% Sub-legal
08-Feb-89	5	35	114.9	10.1	100	140	0.0
08-Feb-89	2E	65	112.9	7.8	99	133	1.5
01-Mar-89	1	100	114.8	9.1	98	139	1.0
05-Jun-89	2E	100	109.7	8.1	97	137	4.0
08-Jun-89	6	48	106.6	5.2	98	122	4.2
06-Oct-89	3, 6	116	111.9	7.8	97	132	2.6
27-Oct-89	1,2E,2W	479	112.9	8.0	98	136	0.6
06-Nov-89	6	161	110.8	6.9	99	131	0.6
06-Nov-89	3	148	106.6	5.3	98	128	2.0
21-Nov-89	6	271	113.8	8.6	98	141	0.4
22-Nov-89	3	29	110.0	5.2	101	119	0.0
1989	Total	1552	111.9		97	141	
19-Feb-88	3, 6	105	111.5	8.1	100	140	0
10-Mar-88	1, 3	101	113.9	7.8	99	138	1.0
27-Apr-88	3	100	109.0	6.3	100	130	0
13-Oct-88	2E, 3	100	110.4	7.1	100	131	0
01-Nov-88	3	65	108.3	6.0	98	127	4.7
01-Nov-88	6	52	109.7	8.0	99	136	1.9
02-Nov-88	6	100	112.1	10.2	99	150	1
23-Nov-88	1 ?	100	109.9	7.4	98	132	4
1988	Total	723	110.8		98	150	
13-Feb-87	6	100	115.3	8.9	95	136	1
04-Mar-87	1	100	117.7	9.6	99	152	1
14-Oct-87	6	100	114.4	7.2	100	139	0
18-Nov-87	2E	102	115.1	8.1	100	130	0
14-Dec-87	3	105	116.6	5.9	104	134	0
15-Dec-87	3	50	110.4	5.2	101	120	0
1987	Total	557	115.3		95	152	
13-Aug-86	6	105	114.8	8.8	100	138	0.0
12-May-86	6	100	111.5	7.1	99	129	0.9
14-Nov-86	1	50	114.6	6.8	104	130	0.0
27-Oct-86	1	100	108.4	4.8	101	125	0.0
06-Feb-86	1	151	111.3	5.2	100	120	0.0
27-Aug-86	3	100	110.7	6.9	100	131	0.0
18-Aug-86	3	101	108.9	6.7	99	129	0.9
29-Sep-86	6	121	106.8	4.7	97	115	4.7
1986	Total	828	110.6		97	138	
24-Apr-85	1	64	112.7	9.7	100	146	0.0
14-Nov-85	6	100	112.7	7.6	91	133	1
12-Jul-85	3	65	107.8	5.5	95	122	1.5
18-Feb-85	5	40	114.3	8.0	93	126	2.5
11-Dec-85	8	102	109.2	6.9	97	138	2.0
18-Nov-85	8	105	108.3	6.4	98	126	1.0
1985	Total	476	110.4		91	146	

Appendix 1: Area 6, 1989, Diving Station Logs.

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 004 DIVER: OIG

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Weeteeam Bay

1989 JUN 23 (PDT) TIME:START: 09:25 FINISH: 09:58

DEPTH FROM DATUM: MAX: 04.2 meters TIDE START: 1.9 meters

EXPOSURE: Ground Swell Normal SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK.(CRV) SLOPE: 80 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	--	0	!	--	0
BOTTOM	--	0	!	--	0
TURF	--	0	!	--	0
ROCKS	Lithothamnion sp.	90	!	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	002		2
ABALONE	.	002	001		1
ABALONE	.	003	001		1
ABALONE	.	004	001		1
ABALONE	.	005	000		0
ABALONE	.	006	002		2
ABALONE	.	007	000		0
ABALONE	.	008	000		0
ABALONE	.	009	003		3
ABALONE	.	010	002		2
ABALONE	.	011	002		2
ABALONE	.	012	002		2
ABALONE	.	013	000		0
ABALONE	.	014	004		4
ABALONE	.	015	000		0
ABALONE	.	016	001		1
SEA URCHIN (RED)	.	999	003 *		3

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 006 DIVER: OIG

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Weeteeam Bay

1989 JUN 23 (PDT) TIME:START: 08:37 FINISH: 09:07

DEPTH FROM DATUM: MAX: 05.3 meters TIDE START: 3.8 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK.(CRV) SLOPE: 50 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	20	!	--	0
BOTTOM	Desmarestia sp.	20	!	--	0
TURF	--	0	!	--	0
ROCKS	Lithothamnion sp.	90	!	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT		COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000			0
ABALONE	.	002	001			1
ABALONE	.	003	000			0
ABALONE	.	004	000			0
ABALONE	.	005	000			0
ABALONE	.	006	000			0
ABALONE	.	007	000			0
ABALONE	.	008	000			0
ABALONE	.	009	000			0
ABALONE	.	010	000			0
ABALONE	.	011	000			0
ABALONE	.	012	000			0
ABALONE	.	013	000			0
ABALONE	.	014	000			0
ABALONE	.	015	000			0
ABALONE	.	016	000			0
SEA URCHIN (RED)	.	999	003	*		3

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 008 DIVER: OBW

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Weeteeam Bay

1989 JUN 23 (PDT) TIME:START: 08:42 FINISH: 09:42

DEPTH FROM DATUM: MAX: 00.6 meters TIDE START: 3.7 meters

EXPOSURE: High Tide Surge Only SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK./BLD. SLOPE: 30 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	10	!	--	0
BOTTOM	Alaria sp.	10	!	Costaria sp.	10
TURF	articulated corallines	10	!	--	0
ROCKS	Lithothamnion sp.	90	!	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	003	000	3
ABALONE	.	002	001	000	1
ABALONE	.	003	001	000	1
ABALONE	.	004	000	000	0
ABALONE	.	005	001	000	1
ABALONE	.	006	000	000	0
ABALONE	.	007	000	000	0
ABALONE	.	008	000	000	0
ABALONE	.	009	000	000	0
ABALONE	.	010	002	000	2
ABALONE	.	011	000	000	0
ABALONE	.	012	001	001	0
ABALONE	.	013	000	000	0
ABALONE	.	014	000	000	0
ABALONE	.	015	000	000	0
ABALONE	.	016	000	000	0
SEA URCHIN (RED)	.	999	003 *		3

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 009 DIVER: OBW

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Weeteeam Bay

1989 JUN 22 (PDT) TIME:START: 10:10 FINISH: 10:33

DEPTH FROM DATUM: MAX: 02.4 meters TIDE START: 1.3 meters

EXPOSURE: High Tide Surge Only SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK./BLD. SLOPE: 60 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	--	0		--	0
BOTTOM	Alaria sp.	10		Laminaria sp.	10
TURF	articulated corallines	10		--	0
ROCKS	Lithothamnion sp.	70		--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	001		1
ABALONE	.	002	000		0
ABALONE	.	003	000		0
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	000		0
ABALONE	.	008	000		0
ABALONE	.	009	000		0
ABALONE	.	010	000		0
ABALONE	.	011	000		0
ABALONE	.	012	000		0
ABALONE	.	013	000		0
ABALONE	.	014	002		2
ABALONE	.	015	000		0
ABALONE	.	016	000		0
SEA URCHIN (RED)	.	999	003 *		3

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 010 DIVER: OIG

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Prior Passage

1989 JUN 23 (PDT) TIME:START: 15:03 FINISH: 15:30

DEPTH FROM DATUM: MAX: 03.1 meters TIDE START: 3.5 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BLD. SLOPE: 30 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO	SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	10	--	0
BOTTOM	Alaria sp.	10	--	0
TURF	--	0	--	0
ROCKS	Lithothamnion sp.	90	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	002		2
ABALONE	.	003	000		0
ABALONE	.	004	002		2
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	000		0
ABALONE	.	008	000		0
ABALONE	.	009	000		0
ABALONE	.	010	000		0
ABALONE	.	011	000		0
ABALONE	.	012	002		2
ABALONE	.	013	000		0
ABALONE	.	014	001		1
ABALONE	.	015	001		1
ABALONE	.	016	000		0
SEA URCHIN (RED)	.	999	003 *		3

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 011 DIVER: OIG

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Prior Passage

1989 JUN 23 (PDT) TIME:START: 13:58 FINISH: 14:44

DEPTH FROM DATUM: MAX: 02.4 meters TIDE START: 1.8 meters

EXPOSURE: Ground Swell Normal SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BLD. SLOPE: 10 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	10	!	--	0
BOTTOM	Alaria sp.	10	!	--	0
TURF	--	0	!	--	0
ROCKS	Lithothamnion sp.	90	!	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	002		2
ABALONE	.	003	000		0
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	001		1
ABALONE	.	007	000		0
ABALONE	.	008	001		1
ABALONE	.	009	001		1
ABALONE	.	010	000		0
ABALONE	.	011	000		0
ABALONE	.	012	001		1
ABALONE	.	013	000		0
ABALONE	.	014	000		0
ABALONE	.	015	000		0
ABALONE	.	016	000		0
SEA URCHIN (RED)	.	999	005 *		5

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 012 DIVER: OBW

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Prior Passage

1989 JUN 23 (PDT) TIME:START: 14:02 FINISH: 14:35

DEPTH FROM DATUM: MAX: 02.2 meters TIDE START: 1.8 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BLD. SLOPE: 10 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Macrocystis integrifolia	50		--	0
BOTTOM	Agarum sp.	90		--	0
TURF	articulated corallines	10		--	0
ROCKS	Lithothamnion sp.	90		--	0

REMARKS: Aborted - Target Species Absent

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	000		0
ABALONE	.	003	000		0
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	000		0
ABALONE	.	008	000		0

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 013 DIVER: OIG

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Anderson Islets

1989 JUN 22 (PDT) TIME:START: 08:57 FINISH: 09:21

DEPTH FROM DATUM: MAX: 03.5 meters TIDE START: 1.0 meters

EXPOSURE: Well Sheltered SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK.(SMO) SLOPE: 60 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	--	0	!	--	0
BOTTOM	--	0	!	--	0
TURF	--	0	!	--	0
ROCKS	Lithothamnion sp.	90	!	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	001		1
ABALONE	.	002	000		0
ABALONE	.	003	000		0
ABALONE	.	004	000		0
ABALONE	.	005	001		1
ABALONE	.	006	000		0
ABALONE	.	007	000		0
ABALONE	.	008	000		0
ABALONE	.	009	000		0
ABALONE	.	010	000		0
ABALONE	.	011	000		0
ABALONE	.	012	000		0
ABALONE	.	013	000		0
ABALONE	.	014	001		1
ABALONE	.	015	000		0
ABALONE	.	016	000		0
SEA URCHIN (RED)	.	999	002 *		2

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 015 DIVER: OIG

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Anderson Islets

1989 JUN 22 (PDT) TIME:START: 09:40 FINISH: 10:36

DEPTH FROM DATUM: MAX: 02.7 meters TIDE START: 0.4 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK./BLJ./CBL. SLOPE: 30 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO	SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	30	--	0
BOTTOM	Alaria sp.	20	Costaria sp.	10
TURF	Ulva sp.	10	--	0
ROCKS	Lithothamnion sp.	90	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	005		5
ABALONE	.	002	006		6
ABALONE	.	003	003		3
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	001		1
ABALONE	.	007	000		0
ABALONE	.	008	000		0
ABALONE	.	009	000		0
ABALONE	.	010	000		0
ABALONE	.	011	002		2
ABALONE	.	012	004		4
ABALONE	.	013	002		2
ABALONE	.	014	005		5
ABALONE	.	015	008		8
ABALONE	.	016	000		0
SEA URCHIN (RED)	.	999	005 *		5

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 016 DIVER: OIG

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Anderson Islets

1989 JUN 22 (PDT) TIME:START: 11:14 FINISH: 11:48

DEPTH FROM DATUM: MAX: 01.5 meters TIDE START: 0.6 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK./BLD./CBL. SLOPE: 20 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	20	!	--	0
BOTTOM	Alaria sp.	20	!	Desmarestia sp.	10
TURF	Ulva sp.	10	!	articulated corallines	10
ROCKS	Lithothamnion sp.	90	!	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	001		1
ABALONE	.	002	000		0
ABALONE	.	003	000		0
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	003		3
ABALONE	.	008	000		0
ABALONE	.	009	000		0
ABALONE	.	010	000		0
ABALONE	.	011	000		0
ABALONE	.	012	000		0
ABALONE	.	013	000		0
ABALONE	.	014	000		0
ABALONE	.	015	000		0
ABALONE	.	016	000		0
SEA URCHIN (RED)	.	999	002 *		2

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 017 DIVER: OBW

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Borrowman Bay

1989 JUN 22 (PDT) TIME:START: 08:45 FINISH: 09:16

DEPTH FROM DATUM: MAX: 01.7 meters TIDE START: 0.7 meters

EXPOSURE: Ground Swell Normal SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK.(SMO) SLOPE: 10 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	10		--	0
BOTTOM	Laminaria sp.	10		Alaria sp.	10
TURF	articulated corallines	10		--	0
ROCKS	Lithothamnion sp.	60		Diatoms - unkown	20

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	000		0
ABALONE	.	003	000		0
ABALONE	.	004	001		1
ABALONE	.	005	001		1
ABALONE	.	006	000		0
ABALONE	.	007	000		0
ABALONE	.	008	000		0
ABALONE	.	009	002		2
ABALONE	.	010	001		1
ABALONE	.	011	000		0
ABALONE	.	012	000		0
ABALONE	.	013	007		7
ABALONE	.	014	002		2
ABALONE	.	015	000		0
ABALONE	.	016	001		1
SEA URCHIN (RED)	.	999	005 *		5

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 018 DIVER: OBW

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Borrowman Bay

1989 JUN 22 (PDT) TIME:START: 09:40 FINISH: 10:30

DEPTH FROM DATUM: MAX: 02.7 meters TIDE START: 0.3 meters

EXPOSURE: Ground Swell Normal SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK.(SMO) SLOPE: 20 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO	SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	10	--	0
BOTTOM	Lithothamnion sp.	10	Costaria sp.	10
TURF	articulated corallines	10	--	0
ROCKS	Lithothamnion sp.	80	Diatoms - unkown	10

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	002		2
ABALONE	.	003	004		4
ABALONE	.	004	001		1
ABALONE	.	005	000		0
ABALONE	.	006	003		3
ABALONE	.	007	000		0
ABALONE	.	008	001		1
ABALONE	.	009	001		1
ABALONE	.	010	002		2
ABALONE	.	011	001		1
ABALONE	.	012	000		0
ABALONE	.	013	001		1
ABALONE	.	014	001		1
ABALONE	.	015	001		1
ABALONE	.	016	000		0
SEA URCHIN (RED)	.	999	005 *		5

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 019 DIVER: OBW

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Kettle Inlet

1989 JUN 22 (PDT) TIME:START: 13:40 FINISH: 14:42

DEPTH FROM DATUM: MAX: 01.1 meters TIDE START: 3.1 meters

EXPOSURE: Ground Swell Normal SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK.(CRV) SLOPE: 20 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO	SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	10	--	0
BOTTOM	Laminaria sp.	20	Costaria sp.	10
TURF	articulated corallines	10	--	0
ROCKS	Lithothamnion sp.	80	Red algae - filamentous	10

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	000		0
ABALONE	.	003	001		1
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	001		1
ABALONE	.	007	000		0
ABALONE	.	008	000		0
ABALONE	.	009	000		0
ABALONE	.	010	000		0
ABALONE	.	011	001		1
ABALONE	.	012	000		0
ABALONE	.	013	000		0
ABALONE	.	014	000		0
ABALONE	.	015	004		4
ABALONE	.	016	000		0
SEA URCHIN (RED)	.	999	003 *		3

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 020 DIVER: OIG

FISHERIES STATISTICAL: region 0 area 06 sub-area 13

LOCATION: Kettle Inlet

1989 JUN 22 (PDT) TIME:START: 13:37 FINISH: 14:30

DEPTH FROM DATUM: MAX: 00.2 meters TIDE START: 3.1 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: CBL./SND./SHL. SLOPE: 10 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Macrocystis integrifolia	30		--	0
BOTTOM	Laminaria sp.	50		Desmarestia sp.	50
TURF	Ulva sp.	20		--	0
ROCKS	Lithothamnion sp.	50		--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	000		0
ABALONE	.	003	000		0
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	002		2
ABALONE	.	008	001		1
ABALONE	.	009	001		1
ABALONE	.	010	000		0
ABALONE	.	011	000		0
ABALONE	.	012	000		0
ABALONE	.	013	001		1
ABALONE	.	014	000		0
ABALONE	.	015	001		1
ABALONE	.	016	000		0

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 021 DIVER: OIW

FISHERIES STATISTICAL: region 0 area 06 sub-area 09

LOCATION: Hickey Island

1989 JUN 20 (PDT) TIME:START: 15:35 FINISH: 16:32

DEPTH FROM DATUM: MAX: 01.3 meters TIDE START: 4.1 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BLD./CBL./GRV./SHL. SLOPE: 00 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	30	!	--	0
BOTTOM	Laminaria sp.	80	!	Cymathere sp.	10
TURF	--	0	!	--	0
ROCKS	Lithothamnion sp.	50	!	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000	000	0
ABALONE	.	002	001	000	1
ABALONE	.	003	000	000	0
ABALONE	.	004	000	000	0
ABALONE	.	005	000	000	0
ABALONE	.	006	000	000	0
ABALONE	.	007	000	000	0
ABALONE	.	008	000	000	0
ABALONE	.	009	001	001	0
ABALONE	.	010	000	000	0
ABALONE	.	011	000	000	0
ABALONE	.	012	002	001	1
ABALONE	.	013	000	000	0
ABALONE	.	014	000	000	0
ABALONE	.	015	000	000	0
ABALONE	.	016	000	000	0

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 022 DIVER: OIW

FISHERIES STATISTICAL: region 0 area 06 sub-area 09

LOCATION: Hickey Island

1989 JUN 20 (PDT) TIME:START: 13:47 FINISH: 14:55

DEPTH FROM DATUM: MAX: 02.3 meters TIDE START: 3.8 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BLD./CBL./GRV./SHL. SLOPE: 00 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO	SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	10	Macrocystis integrifolia	20
BOTTOM	Laminaria sp.	70	Cymathere sp.	20
TURF	Desmarestia sp.	10	articulated corallines	10
ROCKS	Lithothamnion sp.	90	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	001		1
ABALONE	.	003	001		1
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	000		0
ABALONE	.	008	001		1
ABALONE	.	009	001		1
ABALONE	.	010	001		1
ABALONE	.	011	000		0
ABALONE	.	012	001		1
ABALONE	.	013	000		0
ABALONE	.	014	000		0
ABALONE	.	015	000		0
ABALONE	.	016	000		0

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 023 DIVER: OIW

FISHERIES STATISTICAL: region 0 area 06 sub-area 09

LOCATION: Hickey Island

1989 JUN 20 (PDT) TIME:START: 09:10 FINISH: 10:02

DEPTH FROM DATUM: MAX: 02.3 meters TIDE START: 0.7 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK./CBL./GRV. SLOPE: 30 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	10	--		0
BOTTOM	Desmarestia sp.	20	Alaria sp.		10
TURF	articulated corallines	10	--		0
ROCKS	Lithothamnion sp.	90	Diatoms - unkown		10

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	008		8
ABALONE	.	002	000		0
ABALONE	.	003	002		2
ABALONE	.	004	001	001	0
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	000		0
ABALONE	.	008	001		1
ABALONE	.	009	003		3
ABALONE	.	010	001		1
ABALONE	.	011	000		0
ABALONE	.	012	001		1
ABALONE	.	013	001		1
ABALONE	.	014	000		0
ABALONE	.	015	000		0
ABALONE	.	016	000		0
SEA URCHIN (RED)	.	999	010 *		10

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 024 DIVER: OIW

FISHERIES STATISTICAL: region 0 area 06 sub-area 09

LOCATION: Hickey Island

1989 JUN 20 (PDT) TIME:START: 10:40 FINISH: 11:19

DEPTH FROM DATUM: MAX: 02.7 meters TIDE START: 0.3 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK./BLD./CBL. SLOPE: 10 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	10	--		0
BOTTOM	Laminaria sp.	10	Alaria sp.		10
TURF	articulated corallines	10	--		10
ROCKS	Laminaria sp.	50	Diatoms - unkown		40

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	000		0
ABALONE	.	003	000		0
ABALONE	.	004	001		1
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	000		0
ABALONE	.	008	000		0
ABALONE	.	009	000		0
ABALONE	.	010	000		0
ABALONE	.	011	000		0
ABALONE	.	012	000		0
ABALONE	.	013	000		0
ABALONE	.	014	001		1
ABALONE	.	015	001		1
ABALONE	.	016	000		0
SEA URCHIN (RED)	.	999	003 *		3

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 025 DIVER: OBG

FISHERIES STATISTICAL: region 0 area 06 sub-area 09

LOCATION: Hickey Island

1989 JUN 20 (PDT) TIME:START: 10:56 FINISH: 11:50

DEPTH FROM DATUM: MAX: 06.2 meters TIDE START: 1.6 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK.(CRV) SLOPE: 10 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	30	!	--	0
BOTTOM	Laminaria sp.	30	!	Desmarestia sp.	10
TURF	articulated corallines	30	!	--	0
ROCKS	Lithothamnion sp.	90	!	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	000		0
ABALONE	.	003	008		8
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	002		2
ABALONE	.	008	000		0
ABALONE	.	009	000		0
ABALONE	.	010	000		0
ABALONE	.	011	000		0
ABALONE	.	012	000		0
ABALONE	.	013	000		0
ABALONE	.	014	001	001	0
ABALONE	.	015	000		0
ABALONE	.	016	000		0

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 027 DIVER: OBG

FISHERIES STATISTICAL: region 0 area 06 sub-area 09

LOCATION: Hickey Island

1989 JUN 20 (PDT) TIME:START: 13:49 FINISH: 14:49

DEPTH FROM DATUM: MAX: 01.7 meters TIDE START: 3.8 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BLD./CBL./GRV./SHL. SLOPE: 00 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	30	--		0
BOTTOM	Laminaria sp.	20	Costaria sp.		10
TURF	Ulva sp.	40	--		0
ROCKS	Lithothamnion sp.	90	--		0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	001		1
ABALONE	.	002	000		0
ABALONE	.	003	000		0
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	000		0
ABALONE	.	008	000		0
ABALONE	.	009	000		0
ABALONE	.	010	000		0
ABALONE	.	011	000		0
ABALONE	.	012	002		2
ABALONE	.	013	000		0
ABALONE	.	014	000		0
ABALONE	.	015	000		0
ABALONE	.	016	000		0

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 029 DIVER: OBG

FISHERIES STATISTICAL: region 0 area 06 sub-area 09

LOCATION: Hickey Island

1989 JUN 20 (PDT) TIME:START: 09:20 FINISH: 10:10

DEPTH FROM DATUM: MAX: 03.5 meters TIDE START: 0.1 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK./BLD. SLOPE: 20 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	50	!	--	0
BOTTOM	--	0	!	--	0
TURF	articulated corallines	10	!	--	0
ROCKS	Lithothamnion sp.	90	!	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	000		0
ABALONE	.	003	000		0
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	001		1
ABALONE	.	008	001		1
ABALONE	.	009	000		0
ABALONE	.	010	000		0
ABALONE	.	011	000		0
ABALONE	.	012	000		0
ABALONE	.	013	000		0
ABALONE	.	014	000		0
ABALONE	.	015	000		0
ABALONE	.	016	000		0

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 030 DIVER: OBG

FISHERIES STATISTICAL: region 0 area 06 sub-area 09

LOCATION: Hickey Island

1989 JUN 20 (PDT) TIME:START: 15:28 FINISH: 16:14

DEPTH FROM DATUM: MAX: 03.2 meters TIDE START: 4.1 meters

EXPOSURE: Ground Swell Normal SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK./BLD. SLOPE: 20 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	60		--	0
BOTTOM	Cymathere sp.	30		--	0
TURF	--	0		--	0
ROCKS	Lithothamnion sp.	90		--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	001		1
ABALONE	.	002	000		0
ABALONE	.	003	002		2
ABALONE	.	004	000		0
ABALONE	.	005	001		1
ABALONE	.	006	000		0
ABALONE	.	007	000		0
ABALONE	.	008	001		1
ABALONE	.	009	007		7
ABALONE	.	010	002		2
ABALONE	.	011	000		0
ABALONE	.	012	000		0
ABALONE	.	013	002		2
ABALONE	.	014	000		0
ABALONE	.	015	000		0
ABALONE	.	016	000		0

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 033 DIVER: OIG

FISHERIES STATISTICAL: region 0 area 06 sub-area 09

LOCATION: Gillen Harbour

1989 JUN 21 (PDT) TIME:START: 09:12 FINISH: 09:36

DEPTH FROM DATUM: MAX: 04.4 meters TIDE START: 0.2 meters

EXPOSURE: Moderate Exposure SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK.(SMO) SLOPE: 50 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO	SPECIES NAME	%COVER UP TO
CANOPY	--	0	--	0
BOTTOM	--	0	--	0
TURF	--	0	--	0
ROCKS	Lithothamnion sp.	90	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	000		0
ABALONE	.	003	000		0
ABALONE	.	004	001		1
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	001		1
ABALONE	.	008	000		0
ABALONE	.	009	000		0
ABALONE	.	010	002		2
ABALONE	.	011	000		0
ABALONE	.	012	000		0
ABALONE	.	013	000		0
ABALONE	.	014	001		1
ABALONE	.	015	001		1
ABALONE	.	016	002		2
SEA URCHIN (RED)	.	999	005 *		5

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 034 DIVER: OBW

FISHERIES STATISTICAL: region 0 area 06 sub-area 09

LOCATION: Gillen Harbour

1989 JUN 21 (PDT) TIME:START: 10:22 FINISH: 11:08

DEPTH FROM DATUM: MAX: 02.9 meters TIDE START: 0.1 meters

EXPOSURE: High Tide Surge Only SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK./BLD./CBL. SLOPE: 10 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Macrocystis integrifolia	30	!	--	0
BOTTOM	Laminaria sp.	10	!	articulated corallines	10
TURF	--	0	!	--	0
ROCKS	Lithothamnion sp.	90	!	--	0

REMARKS: Aborted - Target Species Absent

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	000		0
ABALONE	.	002	000		0
ABALONE	.	003	000		0
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	000		0
ABALONE	.	008	000		0
SEA URCHIN (RED)	.	999	015 *		15

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 035 DIVER: OBW

FISHERIES STATISTICAL: region 0 area 06 sub-area 09

LOCATION: Gillen Harbour

1989 JUN 21 (PDT) TIME:START: 09:14 FINISH: 09:48

DEPTH FROM DATUM: MAX: 04.1 meters TIDE START: 0.1 meters

EXPOSURE: High Tide Surge Only SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BRK.(SMO) SLOPE: 30 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	Nereocystis luetkeana	10	!	--	0
BOTTOM	--	10	!	Desmarestia sp.	10
TURF	--	0	!	--	0
ROCKS	Lithothamnion sp.	90	!	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	001		1
ABALONE	.	002	000		0
ABALONE	.	003	000		0
ABALONE	.	004	000		0
ABALONE	.	005	000		0
ABALONE	.	006	000		0
ABALONE	.	007	000		0
ABALONE	.	008	000		0
ABALONE	.	009	000		0
ABALONE	.	010	000		0
ABALONE	.	011	000		0
ABALONE	.	012	000		0
ABALONE	.	013	000		0
ABALONE	.	014	000		0
ABALONE	.	015	000		0
ABALONE	.	016	000		0
SEA URCHIN (RED)	.	999	010 *		10

DIVING STATION LOG

ABALONE RESURVEY 1989
ESTEVAN GROUP

VESSEL: Bombard SITE: 036 DIVER: OIG

FISHERIES STATISTICAL: region 0 area 06 sub-area 09

LOCATION: Gillen Harbour

1989 JUN 21 (PDT) TIME:START: 10:28 FINISH: 11:18

DEPTH FROM DATUM: MAX: 02.9 meters TIDE START: 0.2 meters

EXPOSURE: Ground Swell Normal SURVEY DESIGN: 16 quadrats

SUBSTRATE TYPE: BLD./CBL./GRV./SHL. SLOPE: 20 degrees

	DOMINANT ALGAE SPECIES NAME	%COVER UP TO		SPECIES NAME	%COVER UP TO
CANOPY	--	0	!	--	0
BOTTOM	--	0	!	--	0
TURF	--	0	!	--	0
ROCKS	Lithothamnion sp.	90	!	--	0

REMARKS: previous survey site

SPECIES NAME	DEPTH FROM DATUM	QUADRAT NUMBER	TOTAL SPECIES COUNT	COUNT UNDER ROCKS	COUNT ON ROCKS
ABALONE	.	001	004		4
ABALONE	.	002	001		1
ABALONE	.	003	000		0
ABALONE	.	004	000		0
ABALONE	.	005	002		2
ABALONE	.	006	010		10
ABALONE	.	007	001		1
ABALONE	.	008	000		0
ABALONE	.	009	000		0
ABALONE	.	010	000		0
ABALONE	.	011	001		1
ABALONE	.	012	001		1
ABALONE	.	013	000		0
ABALONE	.	014	001		1
ABALONE	.	015	002		2
ABALONE	.	016	000		0
SEA URCHIN (RED)	.	999	002 *		2